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Bureau for Research and Development
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**CONVENTIONAL ENERGY TECHNICAL ASSISTANCE
(CETA) PROJECT**

FINAL REPORT

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Conventional Energy Technical Assistance Project
Project No. 936-5724
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Section 1

SUMMARY

This is the Final Report for the U.S. Agency for International Development (A.I.D.) Office of Energy's 1985-1991 Conventional Energy Technical Assistance (CETA) Project. The Office of Energy (renamed Office of Energy and Infrastructure as of October 1, 1991) implemented this project to provide A.I.D.-assisted countries with technical assistance in the development of indigenous energy resources (fossil fuels and geothermal energy). The Project's emphasis on indigenous energy resources development was a direct consequence of the mid-1970's and early 1980's international oil crises. Both crises, but particularly the second, adversely impacted many developing countries more critically than developed countries because of their heavy dependency on oil imports as a basic energy source. These countries were forced to spend significantly increasing amounts of their scarce hard currency reserves for oil imports. In many cases, they were also forced to reduce energy consumption. The net result was a sharp decline in economic growth rates in many developing countries. Development of indigenous energy resources offers a potential way to mitigate this critical limitation on economic development.

The CETA Project was awarded through competitive bidding to Bechtel National, Inc. in September 1985 based on its experience in planning and managing international energy projects, extensive technical resources, and international presence. As the Project progressed, the dimensions of the energy sector problems facing many A.I.D.-assisted countries shifted. Due to a decline in international oil prices after 1985 and successful programs to reduce the rate of oil imports growth, the main energy problem in many developing countries became one of electricity supply shortage. This shortage directly impacted economic growth by limiting industrial production below physical capability and demand. However, oil import dependency remained a significant problem, and, in some cases, was exacerbated by industry shifting to self-supplied diesel power in response to electricity shortages.

In response to the electricity supply shortage problem, the Office of Energy shifted CETA Project emphasis in 1987 to improvement-expansion of electricity generation with due consideration to the environmental consequences of power technology. Main objectives of the CETA Project included for developing countries: application of conventional and innovative technology for the development of indigenous

energy resources, transfer of proven and environmentally more benign U.S. energy technologies, application of U.S. know-how and financial strategies, and creation in developing countries energy sectors of an awareness of cooperation between governments and the private sector.

The CETA Project was managed by a Project dedicated Washington, D.C. Project Office (WPO) located adjacent to the Office of Energy offices. The WPO would draw upon Bechtel specialists and subcontractors when appropriate. To efficiently address the Project's management challenges, six main management activities were pursued:

- **Program/Project Planning and Management.** Development of annual Project plans and development-implementation of Project major task (major task is the term used to describe a CETA Project major study or service) work scopes.
- **Major Tasks Management.** Major tasks were usually performed by special teams of Bechtel professionals and Project subcontractors with overall WPO management. On average, five major tasks were active at any given time during the Project.
- **Technology State-Of-The-Art Review.** During the entire Project, Bechtel Research and Development (San Francisco) continuously monitored energy technology developments for the Project to: identify technologies for Office of Energy application, inform developing countries of innovative technology options (new and emerging), and contribute insightful information at international seminars and conferences.
- **Technology Transfer.** Special management effort was devoted to communicating Project plans, results, and issues to developing countries officials, A.I.D. Missions, potential energy sector investors (public, private, and multilateral lending institutions), and replicating successful tasks. Technology transfer was facilitated by use of a marketing plan.
- **Unscheduled Requests.** Provision of support to the Office of Energy in responding to requests from Congress, A.I.D. Missions, and other organizations. Over the course of the Project, over 200 unscheduled requests of various types were executed.

- **Project Administration.** Managed and coordinated by the WPO.

Total obligated funds under the CETA Project (six year duration) were \$8.8 Million; including buy-ins of \$3.3 Million. Every dollar funded by the Office of Energy resulted in an additional 60 cents through buy-ins.

Twenty major tasks were performed under the CETA Project. Major tasks had specific work scopes that had at least one of the following attributes: involved field (in-country) support, were A.I.D. Mission or Bureau buy-ins, or involved significant in-country activities. Major tasks are summarized in Table 1.

TABLE 1

**CONVENTIONAL ENERGY TECHNICAL ASSISTANCE (CETA) PROJECT
MAJOR TASKS SUMMARY**

TITLE	COUNTRY	COMMENTS
Prefeasibility Study - Jamshoro Power Generation Complex	Pakistan	Assessed technical options and costs for additional capacity at the Jamshoro Power Station
Natural Gas Utilization as a Transport Fuel	Thailand	Assessed near-to-mid-term potential of natural gas as a transport fuel
System Rehabilitation Assessment and Management Audit of the Ente Nazionale Energia Elettrica (ENEE)	Somalia	Assessed ENEE operations that provided recommendations to improve efficiency
Support Activities for Puspitek Energy Research Laboratory (LSDE)	Indonesia	Development support leading to the establishment of LSDE
Feasibility Study - Jamshoro Power Generation Complex	Pakistan	Evaluated addition of 1,000 MW to the Jamshoro Power Station and alternative methods of fuel transportation
Feasibility Study - Cane/Energy Project	Jamaica	One of the earliest private power feasibility studies
Prefeasibility Study - Oil Shale Utilization for Power Production	Jordan	Assessed the use of indigenous oil shale as a fuel source for electricity; began groundwork towards private power projects
Prefeasibility Study - Mine Mouth Coal-Fired Power Plant	Costa Rica	Assessed the near-to-mid-term potential of indigenous coal as a fuel source for electricity
Design Issues and Options for Private Sector Power Program	Pakistan	Assisted the Government of Pakistan examine issues of private power; provided the groundwork for this movement
Technical, Economic, Financial and Commercial Considerations of the San Miguel Corporation Private Power Program	Philippines	Assessed current and forecasted power needs for the San Miguel Corporation
Trade Mission Regarding Opportunities for Private Investment In Geothermal Power Generation	Philippines	Assisted U.S. small businesses identify private power opportunities
Prefeasibility Study - Generation of Power from Unused Geothermal Energy	Philippines	Assisted U.S. small businesses to identify private power opportunities
Prefeasibility Study - Market for Induction Generator Technology	Indonesia	Assisted U.S. small businesses to identify private power opportunities
Seminar and Roundtable on Private Power Generation Through Build-Operate-Transfer (BOT)	Philippines	One of the earlier efforts to identify the pros and cons of private power

TABLE 1 (Continued)

**CONVENTIONAL ENERGY TECHNICAL ASSISTANCE (CETA) PROJECT
MAJOR TASKS SUMMARY**

TITLE	COUNTRY	COMMENTS
Feasibility Study - Coal Integrated Gasification Combined Cycle (IGCC) Power Technology	India	Evaluation and comparative analysis of U.S. coal gasification technologies using India coal and comparative technical and economic analysis of IGCC versus pulverized-coal power technology
Information Systems Planning and Implementation for Egyptian General Petroleum Corporation (EGPC)	Egypt	Designed a system for data input, retrieval, and communication linking all activities of EGPC
Screening of Combined Cycle Alternatives Including Repowering Options	Philippines	Assessed repowering options for existing thermal power plants with combined cycle technology
Comments and Recommendations on the Draft Bid Document for a 300 MW Combined Cycle Power Project of the National Power Corporation	Philippines	Assisted with the technical and financial aspects of tender documents for the Bataan private power project
Technical Feasibility of Rehabilitation of Selected Power Plants	Panama	Assessed the potential for refurbishing selected generating facilities
Energy Trade Missions Review	Philippines	Assessed past U.S. Government sponsored energy trade missions with emphasis on recommendations for future missions
Power Project Proposals Evaluation Assistance	Philippines	This assistance aided the National Power Corporation in procuring over 1000 MW of generation capacity as private power projects

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Section 2

CONCLUSIONS AND RECOMMENDATIONS

This section presents CETA Project overall conclusions and recommendations. These are based on Project staff experience and perspective and staff interaction with the Office of Energy and A.I.D. Missions. They are not based on formal input, such as questionnaires, from either the Office of Energy or A.I.D. Missions. In developing Project conclusions and recommendations, primary emphasis has been placed on providing guidance for enhancing the development, performance, and effectiveness of Office of Energy CETA follow-on activities.

2.1 CONCLUSIONS. The main Project conclusions relate to how well the CETA Project achieved its overall objectives, how effective it was in implementing major projects and supporting the Office of Energy, and the future need for the technical assistance provided by the CETA Project.

Achieving Project Objectives. For the following reasons the CETA Project is judged to have fulfilled the basic mission established for it by the Office of Energy:

- It successfully responded to a wide range of A.I.D. Mission requests to address specific energy resources development and power generation needs. Twenty major tasks were completed over the Project's six year duration. These ranged from development of oil shale direct combustion electricity generation through supporting developing countries utilities in establishing private power implementation programs.
- The Project was able to fully respond to requirements for applying a diverse range of innovative energy technologies. These included: low heat value fuels fluidized-bed combustion, coal Integrated Gasification Combined Cycle (IGCC) power generation, biomass combustion, and natural gas/distillate fuel combined cycle power technology.

- It completed several pioneering projects in which U.S. developed technologies were adapted to developing countries: coal IGCC power in India, oil shale fluidized-bed combustion in Jordan, an induction generator system in Indonesia, biphasic turbine in the Philippines, utility systems rehabilitation in Somalia, and power plant rehabilitation in Panama.
- It designed and implemented a computer based management information system for the Egyptian General Petroleum Corporation (EGPC). EGPC now has a state-of-the-art management information system with a centralized data base for data storage and retrieval. This system enhances information interchange among EGPC's three operating divisions (exploration, production, and operations) and, as a result, increased productivity.
- It was able to provide direct services to developing countries in formulating private power implementation policies and addressing energy sector financing issues. The Philippines adoption of an aggressive private power program is an example of the Project's success in this area.
- It was a major contributor to expanding the Office of Energy's U.S. energy technology export program. This is reflected in the successful energy trade missions associated with the Project.
- It achieved a high level of A.I.D. Mission buy-ins - \$3.3 million, i.e., each dollar funded by the Office of Energy returned 60% from buy-ins.
- The Project continued to receive requests for technical assistance even in its close-down phase. (These will be handled by a new Office of Energy project - Energy Technology Innovation Project.)
- The basic economic development energy problems that the Project was designed to address are even more relevant today than when the Project was initiated.

Project Implementation. Project implementation was effective, particularly following a shift in Project emphasis from indigenous resources development to power generation from all fuel sources. This was a consequence of the shifting energy priorities of A.I.D. Specific aspects of Project implementation worthy of note are:

- **A.I.D. Missions priorities.** In the initial part of the Project performance period, many Missions did not place high priority in indigenous energy development and had very limited resident energy expertise. The importance of adequate energy supply in accomplishing A.I.D.'s overall development objectives has since reached a higher level of awareness.
- To accomplish Project objectives it was necessary to adapt a proactive marketing program to the Missions and Bureaus. This effort, as indicated by the Project buy-in level, was successful. This effectiveness can be further enhanced by more frequent meetings between Office of Energy staff with the Missions to promote Project capabilities and successes.
- Project implementation was governed by A.I.D. contracting procedures. Each major task required a contract amendment. This, at times, compromises the Project's ability to respond quickly to Mission's needs.

Future Energy Needs. The basic energy supply shortage problem that the CETA Project was designed to address has grown, not diminished, over the course of the Project and acquired two new dimensions: a severe capital shortage and the need to address energy related environmental issues. Technical assistance provided under the CETA Project is still urgently required. Specific areas where developing countries needs are most critical include:

- **Private Power Implementation Support.** Considering the importance to economic development of realizing substantial private power investment, due to severe capital availability limitations, and the emphasis placed by the Office of Energy in initiating other projects that address these areas, continued effort is required in supporting the governmental entities in developing countries charged with formulating and implementing private power policy and programs. The technical support, including assistance in development of a private power projects evaluation methodology, provided by the CETA Project to the Philippines National Power Corporation (NPC) is a good example of the type of support required.

- **Natural Gas Power Development.** Many developing countries are turning to natural gas for fueling their next power blocks. Main reasons for this trend are: successful gas exploration in a significant number of developing countries and natural gas power's comparatively low capital cost, low environmental emissions levels, and comparatively short construction period. Many countries are not experienced in exploiting this resource.
- **Solid Wastes Utilization/Disposal.** Environmentally benign use/disposal of both municipal solid wastes (MSW) and toxic wastes is becoming a critical issue in many developing countries, particularly, in congested urban areas. Though only definitional activities were undertaken by the CETA Project in this area, the need for technical assistance is growing rapidly.
- **Power Facilities Rehabilitation/Repowering.** The growing capital shortage, particularly, of hard currency funds, effecting power projects in developing countries, is resulting in consideration (with encouragement from multilateral lending institutions) of rehabilitation of existing power facilities (power plants, transmission lines, and distribution systems) to extend service life and improve performance. The additional capacity achieved in this manner can frequently be realized at considerably lower capital cost than through new facilities.
- **Clean Coal Technology.** The future of coal-based power may well depend upon the ability to use coal with considerably lower atmospheric emissions of acid rain precursors, particulates, and carbon dioxide than possible with conventional combustion technology. Most developed countries are enforcing regulations which significantly limit the first two types of emissions. International concern over the potential global warming associated with carbon dioxide is a major intergovernmental issue. These trends are now occurring or being encouraged in developing countries. The CETA Project India Coal Integrated Gasification Combined Cycle (IGCC) Feasibility Assessment task is a prime example of how a Clean Coal Technology (CCT) can be adapted beneficially to a developing country.

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- **Management Information Systems Applications.** In the areas of energy development and management, developing countries have as much to gain by application of state-of-the-art, computer-based management information systems (MIS) as do developed countries. The CETA Project's development and implementation of MIS for the Egyptian General Petroleum Corporation, for example, has significantly enhanced their ability to manage operations and monitor oil and natural gas concession activities.

2.2 RECOMMENDATIONS. The main recommendations resulting from the CETA Project are:

- 1) The Office of Energy should continue to provide the energy technical assistance associated with the CETA Project. This type of assistance is even more relevant now than at CETA Project inception. The recent emphasis on reducing energy demand in developing countries through promotion of energy use efficiency improvement and conservation is sound, but this type of assistance will only reduce the growth in real energy demand, not eliminate the need for new energy production capacity.
- 2) Energy development technical assistance needs to be broadened to include assistance in mechanisms for financing projects, implementing private power, and effectively addressing the environmental issues associated with energy production.
- 3) As recognized by the Office of Energy, greater Office presence in the key A.I.D.-assisted countries could greatly facilitate support to Missions, projects identification, projects coordination, and results transfer.

Additional recommendations for Office of Energy consideration are:

- 4) The benefits of developing, as part of major tasks, in-country energy projects support. Structuring of tasks in ways that "encourage" key in-country government and USAID Mission decision makers to interact routinely with the task team promotes the development of task (project) supporters. These "champions" are essential for full project development. One way of achieving the required supporters, applied effectively in the India Coal

Integrated Gasification Combined Cycle Feasibility Assessment, is to make use of an advisory committee(s) and to periodically provide task status briefings, including press briefings.

- 5) Implementation of consistent procedures for trade missions debriefing. From a recent review conducted by the CETA Project of seven 1989-1990 Philippines energy related trade missions, it is clear that consistent procedures need to be developed and implemented for trade missions debriefing and follow-up. Too many missions are not profiting from the lessons learned and contracts developed in previous trade missions.
- 6) Develop improved project funding mechanisms, with appropriate limitations, that would permit Project Officers the flexibility to allow a contractor to begin work and invoice for work before the procurement process is completed.
- 7) Increase Office of Energy coordination and joint projects with trade promotion organizations. The CETA Project has successfully worked with organizations such as the U.S.-ASEAN Council, the U.S. Energy Association, Chambers of Commerce (both U.S. and in-country), and other U.S. energy trade organizations to identify sound projects, promote project results, and conduct trade missions that market U.S. technology and services. These organizations are also essential to gathering the intelligence required for sound project planning and eventual realization.

Section 3

PROJECT OBJECTIVES

The Conventional Energy Technical Assistance (CETA) Project No. 936-5724 (Contract No. LAC-5724-C-00-5126-00) was designed by the U.S. Agency for International Development's (A.I.D.) Office of Energy to provide developing countries with assistance to cost-effectively expand energy supplies. Initiated in September 1985, and completed in August 1991, this Project: provided technical assistance to 18 developing countries; performed 20 major tasks (major studies and services activities); and, carried out numerous unscheduled requests. This report presents an overview of the CETA Project, highlighting major accomplishments. In addition, it fulfills the contractual requirement for a Project final report. Detailed information on individual CETA Project activities are contained in the Projects numerous task reports. A mid-term performance review report (Ref. 1) summarizes Project activities through December 1988.

This report section presents the Office of Energy overall mission, discusses the CETA Project's role within the Office, and traces evolution of Project major objectives. Section 4 describes Project management approach, presents budget and reporting information, and cites examples of typical Office of Energy unscheduled requests. Section 5 summarizes each of the Project's major tasks. An appendix contains a listing of all CETA Project issued formal reports.

3.1 OFFICE OF ENERGY. Adequate and reliable energy supply, particularly, electric power supply, is a fundamental requirement for the economic well-being and sustained economic growth of any economy. Unfortunately, many developing countries lack adequate energy supplies; the main consequences of which are reduced economic growth and the prolonging of poverty. Currently, over half of the A.I.D.-assisted countries are experiencing severe electricity shortages that are exacerbated by increasing demands for additional power. In addition, recently (as in the mid-1970's and early 1980's) these problems are being compounded by the dependance of many developing countries on imported oil with its unstable prices.

The Office of Energy (EY) (newly renamed Office of Energy and Infrastructure (EI) as of October 1, 1991), within A.I.D.'s Bureau for Science and Technology (S&T) (newly renamed Bureau for Research and Development (R&D) as of October 1, 1991), plays a key role in developing and implementing innovative, sustainable programs that address the energy and environmental

needs of A.I.D.-assisted countries. Three key energy issues drive S&T/EY's programs: the need for developing countries to significantly expand energy availability as a requisite to sustained economic growth; the severe financial problems associated with expanding developing countries' energy availability, particularly, electricity sector capital shortages; and, the need to expand energy supply in an environmentally benign manner (Ref. 2).

To cost effectively accomplish its overall mission, S&T/EY has designed and implemented a number of scope specific projects over its existence. The CETA Project is one of these projects. At the Project's completion in 1991, it and five other complementary projects constituted the S&T/EY assistance program. The five other projects are: (1) The Energy Policy Development and Conservation Project (EDPAC); (2) The Biomass Energy Systems and Technology Project (BEST); (3) The Renewable Energy Applications and Training Project (REAT); (4) The Private Sector Energy Development Project (PSED); and, (5) The Energy Training Project (ETP) (Ref. 2).

3.2 CETA PROJECT DEVELOPMENT. The CETA Project grew out of S&T/EY's expansion in the late 1970's from a primarily renewable energy program into a renewables and fossil energy program. This effort was an outgrowth of the rapid, sustained rise in international oil prices in 1973 resulting from the Yom Kippur War. For many developing countries, because of their heavy oil imports dependency, the sharp increase in oil prices resulted in reduced economic growth and a rapid build-up of international debt. Development of indigenous energy resources offered a cost-effective way to mitigate these adverse economic consequences. These resources had, in many countries, been neglected because of low oil prices, lack of demonstrated production and use technology, and/or lack of in-country institutions that could spearhead such development.

An RFP to competitively seek a single energy resources development project contractor was issued in January 1985. The project defined in this RFP, the 1985-1991 CETA Project, was designed to overcome the main barriers, technical and institutional, to developing countries' large-scale development of indigenous energy resources. It was specifically designed to tap U.S. industry know-how to: assist developing countries to identify, evaluate, and develop as energy resources indigenous fossil fuels (oil, gas, coal, oil shale, tar sands and peat), municipal solid wastes (MSW), and geothermal resources, and utilize energy resources more efficiently as ways to reduce imported oil dependency.

Bechtel National, Inc. (Bechtel) was awarded the CETA Project contract in September 1985. The total estimated cost for the contract at award was \$10.9 million.

As the CETA Project progressed after 1985, the dimensions of the energy sector problems facing many A.I.D.-assisted countries shifted. Due to a general decline in international oil prices and, to some extent, the success of government programs designed to reduce oil imports growth, the main energy problem in many developing countries shifted from one of obtaining the hard currency required to pay for oil imports to a critical shortage of electricity. This shortage directly impacted economic growth by limiting industrial production to levels below capability and demand. In some key countries, the deficit between peak electricity demand and available generating capacity exceeded 25 percent of demand (and still does). However, the pressure placed on hard currency availability by oil imports by no means disappeared and the need to find solutions to this limitation on economic development continued to exist.

In response to the electricity supply shortage problem, the S&T/EY developed new projects, particularly, in the area of demand reduction, and shifted CETA Project priorities from fuels exploration production to electricity generation from all energy resources. The desirability of shifting CETA Project emphasis was confirmed during the Project mid-term performance review conducted in 1987. This review recommended an increase in promotional effort to educate A.I.D. Missions on the critical role of energy, particularly electricity, in achieving sustained economic growth (Ref. 1).

Specific activities emphasized by the CETA Project between 1987 and 1991 were: conventional power generation, power plant rehabilitation, private power development (in coordination with the Office's PSED Project), innovative power technology applications assessment (clean coal technology, advance fossil fuel cycles, and advance geothermal technology), biomass fuels power generation, power plant environmental control technology, and design-implementation of energy sector management information systems.

3.3 CETA PROJECT OBJECTIVES. As indicated in the previous subsection, the CETA Project's scope, as defined by the S&T/EY, was quite general in order to comprehensively address the energy and environmental problems impeding economic development. Also, as the demands on S&T/EY shifted, so did the emphasis placed by the CETA Project on specific activities shift. This shifting emphasis is perhaps, best reflected in

the S&T/EY Program Plans issued over the course of the Project. Main project objectives mandated by S&T/EY are:

- 1) "Assist developing countries to identify, evaluate, and develop their conventional energy resources and utilize them in a way which reduces dependence on oil imports." (Ref. 4)
- 2) Promote in developing countries "technology innovation to harness conventional energy resources." (Ref. 5)
- 3) Transfer to developing countries "economically proven and environmentally more benign U.S. energy technologies." (Ref. 6)
- 4) Apply to developing countries' energy sector "U.S. operating know-how and financial strategies." (Ref. 6)
- 5) Create in the energy sector of developing countries "awareness of cooperation between governments and the private sector." (Ref. 6)

The relationship between the CETA Project's objectives and S&T/EY's three driving economic development issues (Ref. 2) - the basic energy shortfall development bind - is presented in Figure 1. As indicated in this Figure, a number of the issues underlying the three drivers provide the rationale for the CETA Project; inadequate energy resources development, inadequate energy supply, poor use of available electricity generation capacity, and environmental degradation. Specific activities undertaken through the CETA Project are identified under each Project objective. The relationship between the major tasks performed and the Figure 1 activities assigned to the CETA Project by S&T/EY are discussed in Section 5.

The CETA technology innovation promotion and transfer objectives were concentrated on environmentally benign electricity generation. Because of the growing electricity shortages in most developing countries and their current adverse impact on economic growth rate (Ref. 7), A.I.D. has assigned priority to the electricity sector. Specific power technologies addressed under the CETA Project are: clean coal, advanced natural gas power, and biomass combustion.

The geographic scope of CETA encompasses all A.I.D.-assisted countries. During the course of this contract, projects and consulting services were provided to over 18 countries.

REFERENCES

1. Evaluation of the USAID Conventional Energy Technical Assistance (CETA) Project (February 1989)
2. Directory Office of Energy (April 1991)
3. CETA Contract (September 1985)
4. Office of Energy Program Plan Fiscal Years 1989 and 1990
5. Office of Energy Program Plan Fiscal Years 1990 and 1991
6. Power Shortages in Developing Countries: Magnitude, Impacts, Solutions, and the Role of the Private Sector, A Report to Congress (March 1988)

NOTE:

Please see last page of Appendix for information regarding obtaining copies of these documents.

Figure 1

Conventional Energy Technical Assistance (CETA) Project Design Logic

Economic Development Energy Drivers/Underlying Issues		
<p><u>POWER EXPANSION</u></p> <ul style="list-style-type: none"> • Policy Deficit • High Energy Demand Growth Rate • Unreliable Supply • Inefficient Operations • High Losses • End-Use Inefficiencies • Inadequate Indigineous Resources Development • Skilled Labor Shortages 	<p><u>FINANCE AVAILABILITY</u></p> <ul style="list-style-type: none"> • Capital Shortages • Limited Hard Currency • Fuel & Power Pricing Distortions • Capital Competition 	<p><u>ENVIRONMENTAL CONTROL</u></p> <ul style="list-style-type: none"> • Acid Rain • Global Warming • Water Pollution • Solid Wastes Management

A.I.D. Office of Energy Projects					
Energy Policy Development & Conservation (EPDAC)	Renewable Energy Applications & Training (REAT)	Conventional Energy Technical Assistance (CETA)	Biomass Energy Systems & Technology (BEST)	Private Sector Energy Development (PSED)	Energy Training Project (ETP)

CETA Objectives				
Assess & Develop Energy Resources	Promote Technology Innovation	Transfer U.S. Energy Technology	Apply U.S. Energy Know-How	Promote Private Sector-Government Cooperation
<ul style="list-style-type: none"> • Energy Exploration and Production • Conventional Energy Resources Assessment/Development • Unconventional Energy Resources Assessment/Development • Establish Energy R&D Centers 	<ul style="list-style-type: none"> • Advanced Power • Environmental Control • Cogeneration • Low-Grade Fuels • Clean Coal Technology 	<ul style="list-style-type: none"> • Plant Rehabilitation • Biomass Energy • Training, Workshops, Seminars • Natural Gas Use • Geothermal Energy 	<ul style="list-style-type: none"> • Utility System Planning • Strengthen Energy Institutions • Electricity Expansion Planning • Management Information Systems 	<ul style="list-style-type: none"> • Project Finance/Planning • Private Sector Project Development • Utilities Private Power Support • Private Power Trade Missions

Section 4

PROJECT MANAGEMENT AND EXPENDITURES

This report section presents an overview of how Bechtel managed the CETA Project, the CETA Project budget including USAID Mission and Bureau buy-ins, CETA Project reports, and summarizes an independent mid-term evaluation of the CETA Project.

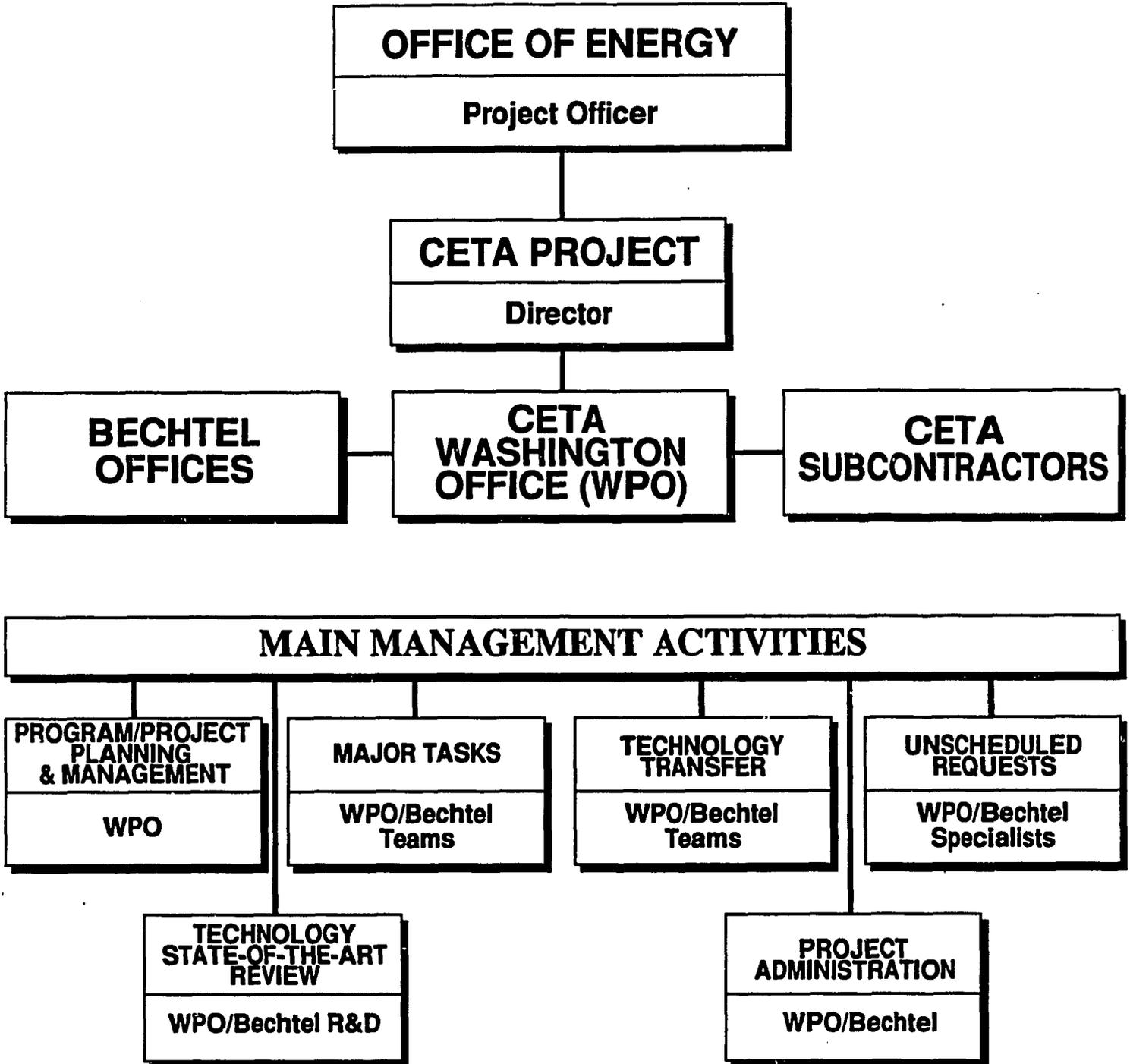
Mr. Alan B. Jacobs, Director of S&T/EY, was the initial CETA Project Officer. He was succeeded by Dr. James B. Sullivan, Director of S&T/EY, in 1986. Mr. Alberto J. Sabadell, Deputy Director of S&T/EY, became the Project Officer in 1988. The CETA Project was organized into two principal parts: the Washington, D.C. Project Office (WPO) and field support. The WPO, located in the same Rosslyn, Virginia building as S&T/EY, was headed by the CETA Project Director. The location of the WPO, next to S&T/EY, was recommended by Bechtel to facilitate communication and coordination between the CETA Project and S&T/EY.

4.1 MANAGEMENT APPROACH AND RESOURCES. CETA Project management encompassed six main activities. These are identified in Figure 2. Bechtel's management sponsor was Dr. Harold K. Forsen, Bechtel Executive Vice President. The initial CETA Project Director was Mr. Richard R. Buta. In 1989, he was succeeded by Dr. Ernest Y. Lam.

Program/Project planning and management was the key to the CETA Project's accomplishment of its objectives. In this activity, the WPO, drawing as required on Bechtel technical, financial, and other specialists, annually developed master program plans based on S&T/EY assigned priorities. Once approved by the Project Officer, detailed work scopes and schedules were developed for specific activities defined by annual program plans. In the case of the Project's major tasks, these work scopes generally required an amendment to the Project contract. All activity schedules included clear milestones for assessing progress of activity programs and reporting. When these tasks involved in-country activities, they were coordinated with the cognizant USAID Mission and Bureau. Coordination with other U.S. agencies such as TDP, DOE, Eximbank, are also routinely carried out.

A key input into Program/Project planning was the appropriateness of specific energy technologies for a given situation and identification of innovative technical approaches for solving developing country energy problems.

Figure 2
CETA Project Management



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These planning inputs were a result of a continuous technology state-of-the-art review conducted by WPO staff as well as Bechtel Research and Development. Results of this technology monitoring process were used to: 1) recommend specific technologies for S&T/EY assessment to address country specific energy problems; 2) inform developing country energy planners and the multilateral lending organizations of potential innovative technology applications; and, 3) contribute insightful information at developing countries energy issues seminars and conferences.

Major CETA Project tasks (major studies or services) had specific work scopes that included at least one of the following attributes: involved Field Support as defined by the prime contract; was a direct USAID Mission or Bureau buy-in; or involved significant in-country presence. All Project major tasks are summarized in Section 5. Most major tasks were performed by teams of Bechtel specialists and, when needed, subcontractors whom were not part of the WPO. A WPO manager, however, retained overall management responsibility for these major tasks. The WPO manager usually worked with a full-time Major Task Leader.

Convincing developing country officials and USAID Missions of the merits of initiating projects, convincing private investors and public and multilateral funding sources to carry capital intensive energy projects to completion (following S&T/EY sponsored feasibility assessments), and replicating successful projects in other A.I.D. countries were major CETA Project activities. Because of their importance to Project success, these and communication related activities were accorded special management attention as technology transfer activities. Bechtel's experience in technology development and commercialization indicates these activities require creative approaches.

To transfer technology, complete projects, and replicate successful projects, the following technology transfer approaches were employed by the WPO task teams:

- Close coordination of project planning and implementation with S&T/EY, involved USAID Mission, and host country officials. This included frequent briefs and review meetings.
- Integration of project financing assessment with technical work to ensure that financing can be arranged. This included working with the multilateral, bilateral and commercial lending institutions.

- Use of in-country expert groups to review and provide inputs to projects. One result of experts group use is the building of strong, knowledgeable in-country project proponents.
- Presentation of projects results at selected seminars and conferences.
- Development of concise project overview documents for major task comprehensive reports.
- Development/implementation of a CETA Marketing Plan for internal CETA Project and S&T/EY use in marketing CETA services to USAID Missions as well as, other U.S. agencies, such as Trade and Development Program and the Department of Energy. Specific marketing activities include: 1) defining the priority services CETA can provide; 2) collecting and analyzing potential markets information; 3) locating the right resources to assess identified markets; 4) marketing tools development; and, 5) marketing strategy development.

CETA assisted S&T/EY develop responses to requests from Congress, Missions, and other organizations. Accordingly, the CETA Contract provided for reacting to Unscheduled Requests. Table 2 presents selected examples of work associated with Unscheduled Requests. This table is intended to illustrate the types of requests handled and not be an exhaustive compilation. Over the course of the Project, over 200 unscheduled requests of various types were executed.

4.2 CETA BUDGET AND SUBCONTRACTS. Total obligated funds for the CETA Project (six years Project duration) were \$8.8 million. S&T/EY funded \$5.5 million and \$3.3 million were from Mission and Bureau buy-ins. That is, for every dollar funded by S&T/EY an additional 60 cents was generated through a buy-in. In performing services under the CETA Contract, Bechtel significantly exceeded its small business plan; over 50% of commitments (\$480,000) for subcontracts were to small businesses and/or small disadvantaged firms.

Table 3 presents the source and amount of contract funds by successive contract amendments and Technical Service Order (TSO) Number. There are, however, a few tasks where TSO's were not assigned by A.I.D. Table 3 also provides a brief description of the scope associated with each amendment.

TABLE 2

SELECTED CETA PROJECT UNSCHEDULED REQUESTS

REQUEST	RESPONSE
<p>Service: Provide a presentation on technological solutions to municipal solid waste disposal problems in developing countries</p> <p>Date: 10/87</p>	<p>Workshop was designed and presented to the staff of Trade and Development Program and S&T/EY</p>
<p>Service: Provide a presentation on private power development</p> <p>Date: 3/88</p>	<p>CETA supplemented the curriculum of a S&T/EY sponsored energy training program at Princeton University for representatives of developing countries with this presentation</p>
<p>Service: Provide a lecture and computer modeling demonstration</p> <p>Date: 6/88</p>	<p>Presentation was given at a S&T/EY sponsored course for representatives of developing countries at the University of Pennsylvania on Energy Policy and Planning</p>
<p>Service: Provide a presentation on the build-own-transfer (BOT) concept</p> <p>Date: 9/88</p>	<p>Presentation was given at the S&T/EY sponsored regional conference in Costa Rica, CENTRAL AMERICAN AND CARIBBEAN WORKSHOP ON ELECTRIC POWER: ROLE OF DEMAND MANAGEMENT AND POLICY ISSUES FOR INDEPENDENT POWER GENERATION</p>
<p>Service: Attend a DOE conference on THE INTERNATIONAL MARKETPLACE - NICHES FOR U.S. COAL TECHNOLOGY</p> <p>Date: 10/88</p>	<p>Provided critique to S&T/EY</p>
<p>Service: Participate in the A.I.D. Administrator's Energy Industry Review Group on Power Shortages in Developing Countries</p> <p>Date: 2/89</p>	<p>The Committee on Appropriations of the U.S. House of Representatives requested A.I.D. provide a report on energy shortfalls in developing countries. CETA participated in the Review Group.</p>
<p>Service: Provide a presentation on A.I.D. assistance programs</p> <p>Date: 11/89</p>	<p>CETA represented S&T/EY at a conference -THE FUTURE OF ELECTRICITY IN THE DEVELOPING COUNTRIES- sponsored by Japan's Electric Power Development Co.</p>
<p>Service: Attend a presentation on fluidized bed combustion</p> <p>Date: 12/89</p>	<p>Provided a summary and critique to S&T/EY sponsored course on Fluidized Bed Combustion by the University of N. Dakota's Energy and Environment Research Center.</p>
<p>Report: Evaluate and provide recommendations on an A.I.D. report on interconnection and parallel operation of private power producers and electric utility systems</p> <p>Date: 3/90</p>	<p>Provided evaluation and recommendations to S&T/EY.</p>

TABLE 2 (Continued)

SELECTED CETA PROJECT UNSCHEDULED REQUESTS

REQUEST	RESPONSE
<p>Report: Evaluate and provide recommendations for an A.I.D. and DOE sponsored seminar</p> <p>Date: 5/90</p>	<p>Input was provided for an A.I.D. and DOE collaboration on a clean coal technology seminar that would, in part, demonstrate U.S. advances in this area to representatives of developing countries.</p>
<p>Report: Review and critique a report by A.I.D. on environmental issues</p> <p>Date: 5/90</p>	<p>Provided evaluation to S&T/EY.</p>
<p>Report: Review and critique a report by DOE on energy cooperation</p> <p>Date: 7/90</p>	<p>Provided evaluation to S&T/EY.</p>
<p>Report: Provide CETA activities related to technology transfer</p> <p>Date: 8/90</p>	<p>Input was provided for an A.I.D. meeting with the International Environmental Technology Transfer Advisory Board.</p>
<p>Report: Review and critique publications by The National Coal Council on energy strategy and industrial use of coal</p> <p>Date: 8/90</p>	<p>Provided evaluation to S&T/EY.</p>
<p>Report: Evaluate and critique an A.I.D. concept report on an environmental screening manual</p> <p>Date: 1/91</p>	<p>Provided evaluation to S&T/EY. S&T/EY was collaborating with multilateral and bilateral organizations to develop a program that would allow government decision makers to assess technology options from an environmental standpoint.</p>
<p>Report: Identify CETA efforts in India, Indonesia, Egypt, Panama, and Philippines</p> <p>Date: 2/91</p>	<p>Input was provided for briefing papers for A.I.D. testimony before Congressional authorization and Appropriation Committee on A.I.D. activities to assist developing countries with fossil fuel resource.</p>
<p>Report: Evaluate and critique an A.I.D. report on combined cycle experience in selected countries</p> <p>Date: 2/91</p>	<p>Provided evaluation to S&T/EY.</p>
<p>Report: Provide summary of two CETA tasks: Management Information Systems Task - Egypt; Integrated Gasification Combined Cycle - India</p> <p>Date: 5/91</p>	<p>Input was provided for an inter-agency effort that A.I.D. was participating in to inventory science and technology projects.</p>

TABLE 2 (Continued)

SELECTED CETA PROJECT UNSCHEDULED REQUESTS

REQUEST	RESPONSE
<p>Service: Coordinate planning and execution of seminar. Participate in a panel discussion at the seminar on S&T/EY activities</p> <p>Date: 5/91</p>	<p>Assistance was provided to S&T/EY for an A.I.D. and DOE co-sponsored international clean coal technology seminar where representatives from developing countries would learn about U.S. advances in this area.</p>
<p>Service: Provide staff support to design and support a training program on S&T/EY activities</p> <p>Date: 6/91</p>	<p>Training materials were assembled and presented as part of an A.I.D. sponsored environmental training program for field staff.</p>
<p>Report: Assess the potential of rice husks in Egypt</p> <p>Date: 6/91</p>	<p>Assessment provided to S&T/EY for response to Congressional oversight question concerning A.I.D. promotion of rice husks as a fuel for power generation.</p>
<p>Service: Provide a presentation on clean coal technologies</p> <p>Date: 7/91</p>	<p>Provided presentation to S&T/EY staff and contractors on U.S. advances in clean coal technology</p>

Table 3

CONVENTIONAL ENERGY TECHNICAL ASSISTANCE PROGRAM

FUNDING 1985-1991

ADMENDMENT	TSO NO.	DESCRIPTION	EFFECTIVE DATE	FUNDING S&T/EY	FUNDING BUY-IN
ORIGINAL	N/A	ESTABLISHED CETA & FUNDING	9/17/85	\$1,800,000.00	
1	1*	PRE-FEASIBILITY STUDY - JAMSHORO-PAKISTAN	11/5/85	\$0.00	\$162,436.00
2	2*	ASSESS NATURAL GAS USE AS TRANSPORT FUEL - THAILAND	11/29/85	\$67,044.00	
2	N/A	ADJUST CORE FUNDING	11/29/85	(\$67,044.00)	
3	3*	TECHNICAL ASSISTANCE-SOMALI POWER CO.	2/11/86	\$60,000.00	
4	1	INCREASE FUNDS & SCHEDULE DUE TO SCOPE CHANGE - JAMSHORO PRE-FEASIBILITY STUDY	6/11/86	\$0.00	\$12,560.00
5	4*	PUSPIPTEK ENERGY RESEARCH LAB - INDONESIA	6/27/86	\$81,163.00	\$121,975.00
6	5*	FEASIBILITY STUDY - JAMSHORO - PAKISTAN	9/17/86	\$0.00	\$500,000.00
6	6*	PRE-FEASIBILITY STUDY - MONYMUSK CANE - JAMAICA	9/17/86	\$91,737.00	
6	7	TECHNICAL SUPPORT FOR PLANNING TASK #5 - JAMSHORO	9/17/86	\$18,658.00	
7	8*	PRE - FEASEABILITY STUDY JORDAN OIL SHALE	9/29/86	\$259,920.00	
7	9*	PRE - FEASEABILITY STUDY COAL-FIRED PLANT- COST RICA	9/29/86	\$86,346.00	
7	10	TECHNICAL ASSISTANCE - DEVELOPMENT OF OIL RESOURCES - NORTH YEMEN	9/29/86	\$8,604.00	
8	8	FEASEABILITY STUDY - JORDON OIL SHALE	10/10/86	\$0.00	\$437,400.00
9	11*	DEVELOPMENT OF PRIVATE SECTOR POWER GENERATION AND DISTRIBUTION PROJECT - PAKISTAN	12/01/86	\$0.00	\$78,024.00
10	11	INCREASE SCOPE AND SCHEDULE - PAKISTAN PRIVATE SECTOR TASK	6/08/87	\$0.00	\$16,014.00
10	5	EXTEND SCHEDULE - JAMSHORO FEASIBILITY STUDY	6/08/87	\$0.00	

Table 3 (Continued)

CONVENTIONAL ENERGY TECHNICAL ASSISTANCE PROGRAM

FUNDING 1985-1991

ADMENDMENT TASK NO.	DESCRIPTION	EFFECTIVE DATE	FUNDING S&T/EY	FUNDING BUY-IN
11	5 INCREASE SCOPE - JAMSHORO FEASIBILITY STUDY	8/20/87	\$0.00	\$50,000.00
11	12 PROVIDE TRAINING IN PETROLEUM MGM'T - ECUADOR	8/20/87	\$0.00	\$85,000.00
12	8 EXTEND SCHEDULE - JORDAN OIL SHALE FEASIBILITY STUDY	9/29/87	\$0.00	
13	13* ASSIST PRIVATE SECTOR SUGAR INDUSTRY IN DEVELOPING DUAL FUEL PROJECTS- PHILIPPINES	9/29/87	\$74,968.00	
14	N/A INCORPORATE CONTRACT CLAUSE	1/07/88	\$0.00	
15	N/A INCORPORATE CONTRACT CLAUSE	3/15/88	\$0.00	
16	8 EXTEND SCHEDULE - JORDAN OIL SHALE FEASIBILITY STUDY	6/14/88	\$0.00	
17	8 EXTEND SCHEDULE - JORDAN OIL SHALE FEASIBILITY STUDY	8/17/88	\$0.00	
18	N/A INCREMENTAL FUNDING INCREASE - CORE ACCOUNT	8/17/88	\$299,902.00	
19	14* TECHNICAL ASSISTANCE TO FACILITATE PRIVATE POWER INVESTMENTS - PHILIPPINES	8/31/88	\$94,804.00	
20	N/A INCREMENTAL FUNDING INCREASE - CORE ACCOUNT	2/06/89	\$478,998.00	
21	8 EXTEND SCHEDULE - JORDAN OIL SHALE FEASIBILITY STUDY	2/06/89	\$0.00	
22	15* ASSESS IGCC TECHNOLOGIES , COMPARE ECONOMICS OF IGCC VS. PC TECHNOLOGIES,ASSESS COAL CLEANING TECHNOLOGY, & PROVIDE RECOMMENDATIONS - INDIA	3/08/89	\$0.00	\$125,000.00
23	N/A REALLOCATE UNSPENT FUNDS TO CORE ACCOUNT	7/05/89	\$0.00	
24	15 INCREASE SCOPE & FUNDING - INDIA IGCC	7/05/89	\$0.00	\$141,858.00
25	16* EVALUATE AND ORGANIZE PETROLEUM RESOURCE DATA AND PROVIDE TRAINING-EGYPT, MIS	6/01/89	\$0.00	\$1,199,998.00
26	N/A INCREMENTAL FUNDING INCREASE - CORE ACCOUNT	8/29/89	\$433,500.00	

Table 3 (Continued)

CONVENTIONAL ENERGY TECHNICAL ASSISTANCE PROGRAM

FUNDING 1985-1991

ADMENDMENT TASK NO.	DESCRIPTION	EFFECTIVE DATE	FUNDING S&T/EY	FUNDING BUY-IN
27	N/A* ADMINISTER PRIVATE SECTOR ENERGY DEVELOPMENT FUND	8/30/89	\$475,000.00	
28	N/A INCREMENTAL FUNDING INCREASE - CORE ACCCUNT	6/18/90	\$1,000,000.00	
29	N/A INCREMENTAL FUNDING INCREASE - CORE ACCOUNT	8/28/90	\$200,000.00	
30	16 SCOPE & SCHEDULE INCREASE - EGYPT, MIS	5/18/90	\$0.00	\$180,000.00
31	N/A* TECHNICAL ASSISTANCE TO NPC -C.CYCLE POWER PROJECT	5/18/90	\$0	\$69,983
32	13,14,15, & 16 EXTEND SCHEDULE TO 3/31/91 - PHILIPPINES, PRIVATE SECTOR SUGAR INDUSTRY - PHILIPPINES, PRIVATE POWER INVESTMENTS - INDIA, IGCC - EGYPT, MIS	1/30/91	\$0	\$0
33	15 EXTEND SCHEDULE TO 6/30/91 - INDIA, IGCC - CORE CONTRACT	4/22/91	\$0	\$0
34	17* ASSIST NPC EVALUATE PRIVATE POWER PROPOSALS	4/1/91	\$0	\$87,221
35	N/A EXTEND SCHEDULE TO 8/31/91 - CORE CONTRACT	6/28/91	\$92,102	\$0
TOTAL			\$5,555,702	\$3,271,469

* indicates CETA Project Major Task

4.3 CETA PROJECT REPORTING. A list of CETA technical reports and technology transfer publications is presented in the Appendix. A total of 25 technical and informational documents were issued under the Project. In addition, the Project prepared numerous reports for inclusion in S&T/EY issued publications.

4.4 CETA PROJECT MID-TERM EVALUATION. The CETA Project mid-term evaluation was performed by an independent third party. The overall conclusion reached by the evaluation team was, "...implementation by the contractor and S&T/EY has overall been of high technical and managerial quality." The evaluation went on to say, "CETA is without a doubt providing a valuable, relevant, and desired service."

Two inhibiting factors that CETA needed to overcome were also identified by the evaluation team, "Difficulty in overcoming lack of interest and understanding of CETA on the part of the missions, other A.I.D. bureaus, and host countries," and "...changing economic realities in the world energy situation, such as reduced oil prices, have shifted the priorities of developing countries and thereby require a reorientation of conventional energy projects that this program was designed to promote." These issues coincided with S&T/EY's and Bechtel's decision to refocus the direction of the CETA Project as discussed in Section 3 under CETA Project Development.

Section 5

MAJOR TASKS

The major tasks performed by the CETA Project are briefly described in this section in the chronological order in which each task began. Figure 3 identifies each major task and indicates how these relate to the CETA Project objectives identified in Figure 1 - Conventional Energy Technical Assistance (CETA) Project Design Logic. Table 3, CETA Project Funding 1985 - 1991, also identifies, in part, the major tasks and indicates the amount and source of funds and the contract amendment authorizing the performance of work. In this section the shaded areas present major task report title, brief description, country, funding source and amount if a buy-in, and period of performance. Please refer to the Appendix for information on how to obtain a copy of a report.

**PREFEASIBILITY STUDY OF THE
JAMSHORO POWER GENERATION
COMPLEX**

Examines potential expansion
of this oil-fired power plant
and an oil pipeline addition
Pakistan
Buy-In @ \$175,000
11/85 - 2/86

The objective of this first major task was to develop guidelines for a feasibility study for construction of additional oil-fired power units at Pakistan's Jamshoro electric generating complex. Specific issues included: optimum unit size, least-cost fuel supply, optimum fuel mix, technology options, and estimated costs. Following

an in-country assessment of energy sector needs, development priorities, institutional barriers, environmental issues, and socioeconomic impacts, the CETA Project drew upon Bechtel's engineering resources and subcontracted portions of the economic analysis to A. D. Little to meet the stated objective. Funding was provided by USAID/Amman and the U.S. Trade and Development Program. The follow-on feasibility study was performed and is discussed on page 5-4.

Figure 3 Conventional Energy Technical Assistance (CETA) Project Major Tasks

MAJOR TASKS	CETA OBJECTIVES/PROJECT ACTIVITIES															COUNTRY								
	I. ASSESS AND DEVELOP ENERGY RESOURCES					II. PROMOTE TECHNOLOGY INNOVATION					III. TRANSFER U.S. ENERGY TECHNOLOGY						IV. APPLY U.S. ENERGY KNOW-HOW					V. PROMOTE PRIVATE SECTOR-GOVT. COOPERATION		
	a. Energy Exploration and Production	b. Conventional Energy Resources Assessment/Development	c. Unconventional Energy Resources Assessment/Development	d. Establish Energy R&D Centers	a. Advanced Power	b. Environmental Control	c. Cogeneration	d. Low-Grade Fuels	e. Clean Coal Technology	a. Plant Rehabilitation	b. Biomass Energy	c. Training, Workshops, Seminars	d. Natural Gas Use	e. Geothermal Energy	a. Utility System Planning	b. Strengthen Energy Institutions	c. Electricity Expenditure Planning	d. Management Information Systems	a. Project Finance/Planning	b. Private Sector Project Development	c. Utilities Private Power Support	d. Private Power Trade Missions		
1. Feasibility Study—Jamshoro Power Generation Complex					●	●										●						Pakistan		
2. Natural Gas Utilization as a Transport Fuel	●				●							●										Thailand		
3. System Rehabilitation Assessment and Management Audit of the Ente Nazionale Energia Elettrica (ENEE)										●				●	●	●						Somalia		
4. Support Activities for Pusptek Energy Research Laboratory (LSDE)			●			●				●					●							Indonesia		
5. Feasibility Study—Jamshoro Power Generation Complex					●	●				●						●						Pakistan		
6. Feasibility Study—Cane/Energy Project			●				●			●	●							●	●			Jamaica		
7. Feasibility Study—Oil Shale Utilization for Power Production			●		●	●		●		●						●		●	●			Jordan		
8. Feasibility Study—Mine-Mouth Coal-Fired Power Plant	●	●			●	●	●	●	●	●				●		●			●			Costa Rica		
9. Design Issues and Options for Private Sector Power Program										●				●				●	●			Pakistan		
10. Technical, Economic, Financial and Commercial Considerations of the San Miguel Corporation Private Power Program			●						●							●		●	●			Philippines		
11. Seminar and Roundtable on Private Power Generation through Build-Operate-Transfer (BOT)										●								●	●			Philippines		
12. Feasibility Study—Coal Integrated Gasification Combined Cycle (IGCC) Power Technology					●		●	●						●				●				India		
13. Information Systems Planning and Implementation for Egyptian General Petroleum Corp.	●									●				●		●						Egypt		
14. Administration of the Private Sector Energy Development Fund																		●	●	●		A.I.D. Assisted Countries		
15. Screening of Combined Cycle Alternatives Including Repowering Options					●	●			●					●						●		Philippines		
16. Comments and Recommendations on the Draft Bid Document for a 300 MW Combined Cycle Power Project of the National Power Corp.					●													●	●			Philippines		
17. Power Project Proposals Evaluation Assistance										●								●		●		Philippines		
18. Technical Feasibility of Rehabilitation of Selected Power Plants									●									●	●			Panama		
19. Trade Missions	●	●			●	●	●		●	●	●	●						●	●		●	Philippines, Indonesia		
20. Energy Trade Missions Review																				●		Philippines		

**NATURAL GAS UTILIZATION AS A
TRANSPORT FUEL IN THAILAND**

Screening study to determine
the most promising
technologies for production of
liquid fuels
Thailand
S&T/EY Funds
11/85 - 9/86

The objectives of this task were to identify the most promising technologies for production of liquid transportation fuels, such as methanol or gasoline, from natural gas and to compare these fuel alternatives to compressed natural gas for use as a transportation fuel. A CETA Project team led by Bechtel and supported by Price Waterhouse performed

an in-country assessment of energy needs in the transportation sector, developed forecasts for natural gas development, assessed fuels economics and market potential, and identified institutional issues and future development priorities. This study provided government decision makers a sound resource to guide them in long-range energy planning.

**SYSTEM REHABILITATION
ASSESSMENT AND MANAGEMENT**

AUDIT OF THE ENTE NAZIONALE
ENERGIA ELETTRICA
Electric utility operations
improvement
Somalia
S&T/EY Funds
2/86 - 5/86

The objectives of this task were to assess and determine improvements for: Somalia Power Company's (ENEE) system rehabilitation and current operations, including ENEE's accounting system, customer bill collection system, manpower needs planning, and training. In achieving these objectives, the following tasks were performed:

reviewed power demand forecasting and system planning; evaluated required rehabilitation of the generation, transmission, and distribution systems; evaluated the electrical system and billing losses; assessed the ENEE procurement process and inventory control methods for equipment and spare parts; reviewed financial management procedures, accounting system, and billing and collection procedures; reviewed existing manpower training programs; and, assessed manpower needs. Recommendations were provided to ENEE so that programs could be implemented to improve their overall plant and operations.

BECHTEL SUPPORT ACTIVITIES FOR LSDE

Technical assistance to LSDE for development of the Puspitek Energy Research Laboratory

Indonesia

Buy-In @\$121,975 and S&T/EY Funds

1/86 - 6/86

The objectives of this task were to assist the Laboratorium Sumber Daya Energi (LSDE) of Indonesia: develop a framework for organization, establish policy with respect to operations and other related agencies, prioritize research projects, and develop staff capabilities for a new energy research center, the Puspitek Energy Research Laboratory

(PERL). In achieving these objectives, CETA worked closely with Government of Indonesia (GOI) officials and scientists to: review LSDE's master plan; analyze research projects to determine their suitability for PERL; review with GOI agencies and industry specific needs that could be served by PERL; plan staff development; and, plan specific combustion research projects. PERL is now a functioning contributor to Indonesia's research community and is at the forefront of characterizing the combustion properties of Indonesia coals by means of: laboratory analysis; bench-scale tests; and, use of a 5 MBtu/h, state-of-the-art combustion furnace.

FEASIBILITY STUDY - JAMSHORO POWER GENERATION COMPLEX - PHASE II

Comprehensive study for selecting number and capacity of units and fuel supply mode Pakistan

Buy-In @ \$554,000

2/86 - 12/86

The objectives of this task, building upon the results of the prefeasibility study (p. 5-1), were to determine the optimum power plant design and oil transport system to meet an aggressive construction schedule and stringent air quality standards. Drawing upon Bechtel's resources, CETA met all project objectives. To

achieve these objectives, CETA developed: plant and oil transport system designs, capital and operating cost estimates, schedules, plant operating procedures, major equipment lists, construction approach, and economic and financial analyses. A comprehensive environmental impact assessment was also performed. Finally, comparisons were made between competing design options to determine the economically optimum expansion program. This effort and the prefeasibility

study (TSO No. 1) provided a comprehensive data base that allowed government decision makers to compare new power supply options and proactively plan for Pakistan's future energy needs.

**JAMAICA CANE/ENERGY PROJECT -
FEASIBILITY STUDY**

Evaluate the feasibility of a private bagasse power project as an addition to the Monymusk Sugarcane Factory

Jamaica

S&T/EY Funds

3/86 - 9/86

This task evaluated the technical, economic, and financial feasibility of the private sector installing and operating an electric power cogeneration facility fueled by bagasse and sugar cane field trash. The study evaluated the economic and operations availability benefits that can be achieved by the sugar company through

integrating sugar production and power generation. This effort was performed with the assistance of Ronco Consulting Corporation.

**PREFEASIBILITY STUDY - OIL
SHALE UTILIZATION FOR POWER
PRODUCTION IN THE HASHEMITE
KINGDOM OF JORDAN**

Assesses the exploitation of indigenous oil shale in an environmentally sound manner

Jordan

S&T/EY Funds

9/86 - 5/89

The objective of this task was to determine the potential for exploiting indigenous oil shale to produce electricity in an environmentally sound manner using Atmospheric Pressure Fluidized-Bed Combustion (AFBC) technology. A CETA team led by Bechtel with contributions from the Jordan Electric Authority, Oak Ridge National Laboratory, and Pyropower

Corporation performed an in-country assessment of: energy needs, power plant development priorities, institutional barriers, oil shale reserves, and environmental impacts for an oil shale power project. The team identified mining and combustion technical options and developed conceptual power plant designs ranging from 50 to 400 MW. Economic and financial analyses were also performed which compared private investment oil-based, coal-based, and oil shale-based power generation. Oil shale was found to be competitive with both of the two conventional fuel options.

Jordan is heavily dependent upon imported oil for meeting electricity requirements. This effort provided a comprehensive assessment of an efficient, environmentally sound alternative technology that allows Jordan to diversify their energy mix and reduce their reliance upon imported oil. As a result of this effort, a private power conference was organized by CETA to help the Government of Jordan understand the complex issues associated with private power projects.

**PREFEASIBILITY STUDY OF COAL
USE IN COSTA RICA**

Assess the potential of using
indigenous coal to produce
electricity
Costa Rica
S&T/EY Funds
9/86 - 3/87

The objective of this task was to determine the potential of indigenous coal as a fuel source to meet current and future power needs in Costa Rica. Following an in-country assessment of energy needs, coal reserves, coal characteristics, and environmental issues, CETA investigated innovative mining methods, and

developed conceptual mine and power plant designs. The economic analysis indicated that a 50MW power plant was quite competitive with oil-fired power plants. Because Costa Rica is heavily dependent upon imported oil to meet power needs, this study provided the Government of Costa Rica with an assessment of energy options for use in planning future energy development.

**PROGRAM DESIGN ISSUES AND
OPTIONS - PRIVATE SECTOR POWER
PROGRAM IN PAKISTAN**

Provided assistance to the
Government of Pakistan to
implement its policy to
mobilize private sector
resources to expand power
sector capabilities
Pakistan
Buy-In @ \$78,000
10/86 - 1/87

The objective of this task was to assist the Government of Pakistan implement its policy to mobilize private sector resources for expanding power sector capabilities. In achieving this objective, CETA assembled a team of experts from Bechtel and Arthur D. Little to perform an in-country assessment of public and private sector concerns in Pakistan and held discussions in Washington with officials. The task report clearly

from the World Bank and A.I.D.

indicates there is a role for the private sector and identifies the policy, institutional, and financial constraints that need to be addressed in attracting private power sector investment.

**TECHNICAL, ECONOMIC, FINANCIAL
AND COMMERCIAL CONSIDERATIONS
OF THE SAN MIGUEL CORPORATION
PRIVATE POWER PROGRAM**

Assess the potential of private power options for the industrial complexes operated by the San Miguel Corp.

Philippines
S&T/EY Funds
9/87 - 4/91

The objectives of this task were to assess the technical, commercial, economic, and financial aspects of alternatives for generation of electricity at selected San Miguel Corporation (SMC) breweries. In achieving these objectives, CETA assembled a team led by Bechtel and supported by K&M Engineering and Consulting Corporation to perform an in-country assessment of

two SMC breweries. The team assessed future electricity and steam demand, alternative fuel sources, institutional constraints, and technology options. The team then estimated capital and operating costs based on conceptual designs, identified potential financing sources and approaches, and estimated electricity generation and steam production costs. This effort was instrumental in allowing SMC to weigh various cogeneration options and to plan for its future energy needs.

TRADE MISSIONS

Philippines:

- REPORT ON A MISSION TO THE PHILIPPINES REGARDING THE OPPORTUNITIES FOR PRIVATE INVESTMENT IN GEOTHERMAL POWER GENERATION
- PREFEASIBILITY STUDY OF GENERATION OF POWER FROM UNUSED GEOTHERMAL ENERGY IN THE PHILIPPINES

Indonesia:

- FINDINGS FROM A PREFEASIBILITY STUDY ON THE MARKET FOR INNOVATIVE ELECTRICITY GENERATION EQUIPMENT FINAL REPORT

CETA aided U.S. small businesses to investigate private power opportunities in the Philippines and Indonesia. CETA participated in A.I.D.'s Energy Review Mission and provided planning support for the multiagency sponsored U.S. Energy Trade and Investment Mission to ASEAN.

Philippines and Indonesia
S&T/EY Funds
12/88 - 12/90

The primary objective of these trade missions was to determine the opportunities for U.S. exports and/or investments while seeking a means to alleviate critical power shortages. The missions provided a forum for one-on-one meetings between senior government officials and company executives in the respective countries and U.S. energy companies. CETA, for example, led three separate U.S. small businesses on missions. As a result, these companies have identified specific projects to pursue. One of these firms is currently negotiating a private power project.

**PHILIPPINE SEMINAR AND
ROUNDTABLE ON PRIVATE POWER
GENERATION THROUGH BUILD-
OPERATE-TRANSFER (BOT)**

Assist the government of the
Philippines and the private
sector understand the BOT
concept

Philippine
S&T/EY Funds
10/88 - 5/89

The objective of this seminar was to facilitate a dialogue between the Government of the Philippines (GOP) and the private sector to enable both sides to have a better understanding of private power projects under the BOT concept. In particular, the seminar assisted the Philippines Government in refining the private power program within the context of the nation's laws and

regulations. The seminar was attended by over 200 participants and provided a balanced perspective on the issues facing the private and public sectors in development of future power projects.

The second day of the seminar was by invitation and limited to key lawmakers, government officials, and private business leaders who had a direct role in shaping the private power policy of the Philippines Government. This session served as a forum for discussion and debate of the various issues relating to current private power enabling legislation.

**FEASIBILITY ASSESSMENT OF COAL
INTEGRATED GASIFICATION
COMBINED CYCLE (IGCC) POWER
TECHNOLOGY FOR INDIA**

Evaluate and rank potential
coal gasification processes
and compare these processes to
pulverized coal power
technology

India
Buy-In @ \$ 267,000
3/89 - 6/91

The objectives of this task were: 1) evaluate the technical and economic aspects of integrated gasification combine cycle (IGCC) technology using low-grade indigenous coal; 2) evaluate, compare, and select a coal gasification process best suited to India conditions; 3) perform a technical and economic comparison against pulverized coal power plants; and, 4) establish a demonstration program. CETA assembled a

team of specialists from Bechtel and, in a collaborative effort with the Council for Scientific and Industrial Research of the Government of India (GOI), met the stated objectives. The project team performed an in-country assessment of energy

sector needs, development priorities, and identified institutional barriers and coal resources. The team then assessed and evaluated the technical aspects of competing coal gasification processes, developed conceptual power plant designs, analyzed a wide range of technical and economic scenarios, and, finally, identified opportunities for the private sector. The effort has been well received by the GOI. IGCC technology can provide India with an efficient, environmentally sound power technology. As a result of this task, the GOI is moving forward with a 30 MW demonstration IGCC power plant as the next phase towards IGCC power commercialization.

**INFORMATION SYSTEMS PLANNING
AND IMPLEMENTATION PROJECT**

Develop and implement at the Egyptian General Petroleum Corporation a management data base system to permit enhanced information interchange between the exploration, production, and operations divisions

Egypt

Buy-In @ \$1,380,000

6/89 - 6/91

The objectives of this task were: design the overall system for data input, retrieval, and communication; define information requirements for each of the three divisions (exploration, production, and operations); provide and integrate applications software; upgrade the Egyptian General Petroleum Corporation's (EGPC) central library; and, train EGPC personnel. CETA assembled a team of specialists from Bechtel

and performed an in-country assessment of EGPC's data needs, goals, and objectives. The task was coordinated with EGPC to develop a meaningful, user-friendly management data base systems. In-country training was carried out to demonstrate developed system capabilities. A technology transfer mission was organized in which EGPC senior executives witnessed first-hand demonstrations of U.S. advances in management information systems. EGPC now has a state-of-the-art management information system with a centralized data base system for data storage and retrieval. Personnel have been trained and the library contains topical and relevant resources. The use of this system enhances information interchange and has increased productivity, enabling EGPC to effectively lead the Egyptian petroleum sector. EGPC, to illustrate, now has the ability to collect, analyze, and rank well-head data from existing fields, allowing it to promote exploration to concessionaires.

ADMINISTRATION OF THE PRIVATE
SECTOR ENERGY DEVELOPMENT FUND
Administration services for
the newly implemented fund
International
S&T/EY Funds
8/89 - 6/91.

The primary objective of this task was to provide administrative support for this newly developed feasibility fund. The Private Sector Energy Development (PSED) Fund was designed by S&T/EY to assist the private sector reduce the front-end risks associated with the development of private

power projects in A.I.D.-assisted countries, and as a means of helping these countries increase their power capacity. Assistance to the private sector involved sharing up to 50% of the study costs. CETA activities included: assisting with program controls (threshold criteria for the applicants, development of the Fund application form and evaluation criteria), designing and placement of advertizing, and negotiating and administering subcontracts with A.I.D. selected recipients.

SCREENING OF COMBINED CYCLE
ALTERNATIVES INCLUDING
REPOWERING OPTIONS IN THE
PHILIPPINES
Assessment of existing power
plants to determine the
possibility for repowering
Philippines
Buy-In @ \$70,000
5/90 - 9/90

The objective of this task was to perform a screening study of combined cycle alternatives including repowering options. In achieving this objective, CETA assembled a team of Bechtel power specialists and inspected selected existing thermal power plants to evaluate the potential for repowering and for a new combined cycle plant. In this task: technology options

were identified and evaluated; conceptual plant designs were developed; environmental impacts were assessed; opportunities for private and public sector participation were assessed, technical, economic, and financial analyses were made; risk assessments were performed; and, financing options were identified. Each case was evaluated and ranked. Advantages and disadvantages were provided with recommendations on the best options for rapidly expanding electricity generating capacity.

This effort provides the National Power Corporation decision makers with an assessment of innovative technical options that

allows proactive energy planning. The final report of this task was also distributed to targeted A.I.D.-assisted countries to promote combined cycle technology.

**COMMENTS AND RECOMMENDATIONS
ON THE DRAFT BID DOCUMENT FOR
A 300 MW BATAAN COMBINED CYCLE
POWER PROJECT OF THE NATIONAL
POWER CORPORATION**

Evaluated the technical and financial bid document
Philippines
S&T/ET Funds
9/90 - 10/90

The objective of this task was to provide comments on the technical and financial aspects of an upcoming request for proposal (RFP) by the National Power Corporation (NPC) for the private power 300 MW Bataan Combined Cycle Power Plant. The basis for this assistance was to increase the probability of meaningful and responsive proposals and equitable

competition in the international marketplace. To this end, CETA assembled a team of specialists to review and evaluate the RFP. Recommendations included: allocation of risks, suggested contractual terms sheets, project financing details, and technology applications. This effort provided NPC with an objective overview and was instrumental in receiving quality proposals on schedule.

**TECHNICAL FEASIBILITY OF
REHABILITATION OF SELECTED
IHRE FACILITIES**

Assess and rank the potential of existing generating plants to be rehabilitated.
Panama
S&T/EY Funds
1/91 - 5/91

The objective of this task was to assess the feasibility of rehabilitating selected Instituto de Recursos Hidroelectricas y Electrificacion (IHRE) generating facilities. CETA provided power engineering specialists from Bechtel as part of a S&T/EY multidisciplined team to conduct an assessment of the

potential for private investment in refurbishing selected power plants. Several plants were evaluated, costs and schedules were developed, and recommendations were provided.

Following this task, CETA provided power engineering specialists to assist IHRE with the development of the technical specifications for tender documents. The CETA team,

working closely with USAID/Panama and IHRE, assisted in integrating the technical specifications with the entire tender document. IHRE is moving forward with the recommendations and has recently issued a request to the private sector for proposals.

PHILIPPINES ENERGY TRADE MISSIONS REVIEW

Reviewed seven U.S.-to-the-Philippines trade missions to determine lessons learned to improve energy trade and future trade mission planning
Philippines
S&T/EY Funds
2/91 -5/91

The objectives for this task were: consolidate information, identify successful mission activities, identify trade impediments, and recommend concepts for future energy trade missions. From January 1989 to December 1990, seven U.S. trade missions to the Philippines were undertaken. Although the objectives of these missions varied, a common

aspect was energy trade. CETA, in performing this assessment, reviewed the reports of these missions and interviewed selected government officials and private sector executives who took part in the missions. The report for this task has been widely distributed within A.I.D., other U.S. agencies, the Philippines Government, and the U.S. and Philippines private sector.

REPORT FOR THE NATIONAL POWER CORPORATION - EVALUATION ASSISTANCE FOR POWER PROJECT PROPOSALS

Assist with the evaluation methodology of specific private power proposals
Philippines
Buy-In @ \$87,200
4/91 - 6/91

The objective of this task was to assist the National Power Corporation (NPC) evaluate various private power proposals. In achieving this objective, CETA provided a team of financial and power engineering specialists that worked closely with NPC to evaluate private power proposals for the 300 MW Bataan and 700 MW San Juan Projects. Specifically, CETA contri-

buted the methodology and tools needed for NPC to reach a decision on each project and performed a detailed review of projects proposals. NPC is moving forward with the award of these private power projects and has signaled their commitment

to seek alternative means to generate electricity. Moreover, the awards also represent a significant achievement in S&T/EY's efforts to assist the Philippines to overcome the severe power shortages that have hindered its economic growth.

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2. Directory Office of Energy (April 1991)
3. CETA Contract (September 1985)
4. Office of Energy Program Plan Fiscal Years 1989 and 1990
5. Office of Energy Program Plan Fiscal Years 1990 and 1991
6. Power Shortages in Developing Countries: Magnitude, Impacts, Solutions, and the Role of the Private Sector, A Report to Congress (March 1988)

NOTE:

Please see last page of Appendix for information regarding obtaining copies of these documents.

APPENDIX

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1. Petroleum Training Program Evaluation Report, January 1986
2. Prefeasibility Study of the Jamshoro Power Generation Complex, February 1986
3. System Rehabilitation Assessment and Management Audit of the Ente Nazionale Energia Elettrica (ENEE) Mogadishu, Somalia, May 1986
4. Bechtel Support Activities for ISDE, July 1986
5. Natural Gas Utilization as a Transport Fuel in Thailand, September 1986
6. Jamaica Cane/Energy Project - Feasibility Study, Volume 1 - September 1986; Volume 2A - September 1986; Volume 2B - September 1986
7. Program Design Issues and Options - Private Sector Power Program in Pakistan, January 1987
8. Prefeasibility Study of Coal Use in Costa Rica, Report on Task 1 - Coal-Fired Power Plant - June 1987; Report on Task 2 - Coal Reserves and Mine Plan Assessment - March 1987; Report on Tasks 3, 4, 5 & 6 - March 1987
9. Feasibility Study - Jamshoro Power Complex - Phase II, Environmental and Social Soundness Assessment - Final Report - March 1987; Volume 2 - Feasibility Study - March 1987; Volume 3 - Feasibility - March 1987; Volume 3 - Feasibility Study - March 1987; Volume 4 - Feasibility Study - March 1987
10. Prefeasibility Study - Oil Shale Utilization for Power Production in the Hasemite Kingdom of Jordan, Volume 1 of VI - Executive Summary and Study Report - May 1989; Volume II of VI - Oral Presentation, Questions and Answers - May 1989; Volume III of VI - Appendices 1 thru 4 - Design Basis, Geological Data, Pyroflow Process, Blended Shale Sample Report - May 1989; Volume IV of VI - Appendix 5 - Mining Study - May 1989; Volume V of VI - Appendix 6 - ORNL Study - May 1989; Volume VI of VI - Appendices 7 thru 12 - Bechtel/Pyropower Design Studies - May 1989
11. Summary Report of the Philippine Seminar and Roundtable on Private Power Generation Through Build-Operate-Transfer (BOT), May 1989 (S&T/EY Report No. 89-04)

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12. Technical, Economic, Financial and Commercial Considerations of the San Miguel Corporation Private Power Program, August 1989 (S&T/EY Report No. 89-11)
13. Private Power Projects in Developing Countries Summary Report on a Conference in Amman, Jordan, December 1989 (S&T/EY Report No. 91-01)
14. Egyptian General Petroleum Corporation Information Systems Planning and Implementation Project, June 1990; Volumes I, II and III
15. Screening of Combined Cycle Alternatives Including Repowering Options in the Philippines, October 1990 (S&T/EY Report No. 90-11)
16. Comments and Recommendations on the Draft Bid Document for a 300 MW Bataan Combined Cycle Power Project of the National Power Corporation, October 1990
17. Report on a Mission to the Philippines Regarding the Opportunities for Private Investment In Geothermal Power Generation, December 1990
18. Technical Feasibility of Rehabilitation of Selected IHRE Facilities, February 1991
19. Findings from a Prefeasibility Study on the Market for Innovative Electricity Generation Equipment Final Report, February 1991
20. Prefeasibility Study of Generation of Power from Unused Geothermal Energy in the Philippines, March 1991
21. Philippines Energy Trade Missions Review, May 1991 (S&T/EY Report No. 91-10)
22. Feasibility Assessment of Coal Integrated Gasification Combined Cycle (IGCC) Power Technology for India, June 1991
23. Report for the National Power Corporation - Evaluation Assistance for Power Project Proposals, June 1991
24. Turbine Failure at Kot Addu Power Station, July 1991
25. PROJEV Model Review, July 1991

APPENDIX (Continued)

LIST OF REPORTS

NOTE:

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